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Suggestion for Flexible Load Grant Funding Opportunity as part of EPIC Program

Suggestion for Flexible Load Grant Funding Opportunity as part of the EPIC 2018 â€“ 2020 Triennial Investment Plan.

Additional submitted attachment is included below.

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The Energy Commission is currently soliciting ideas and stakeholder input for the 2018 – 2020 EPIC Triennial Investment Plan. For those that would like to submit an idea for consideration in the 2018-2020 EPIC Triennial Plan, we ask that you complete the form below. Submittals are due by **5:00 p.m. on February 10, 2017.**

Part 1. Initiative Description and Purpose:

1. Please provide a brief description of the proposed initiative:

Conventional wisdom is that residential consumers save energy and lower energy bills by raising the thermostat temperature during hot summer days, i.e., by reducing daytime A/C loads, when the occupant is not at home. However, this is not the case when solar PV power is available-- especially on California's high penetration grid. This initiative challenges the prevailing view by evaluating the potential benefits of building pre-cooling with residential rooftop PV.

Pre-cooling would provide needed on-site A/C loads for solar electricity. This is preferable to exporting the energy to the grid when it is not needed. In effect, pre-cooling the home with solar power shifts the loads from the evening to daytime, taking advantage of the built-in thermal mass of the building.

Advantages include: (1) the reduced need for evening cooling; (2) the avoidance of imported grid power and the increase in utility bill savings; (3) the reduced dependency on NEM rates, which may not be available to PV customers in the future; (4) the reduction of peak generating capacity needs in the early evening hours; (5) the avoidance of possible future curtailment of PV energy during the daytime periods of solar over-generation; (6) the reduction in carbon footprint-- evening cooling is provided by daytime solar rather than on-demand fossil resources.

The approach is similar to energy storage, such as batteries, in the sense that both energy storage and pre-cooling effectively shift loads from evening to daytime. However, pre-cooling can be performed with no capital expense on existing homes. It can be used on homes with PV installed or more broadly on any home in California where there is an abundance of solar energy available.

2. What technical and/or market barriers would the proposed initiative help overcome? For scientific analysis and tools, what knowledge gaps would the proposed initiative help fill?

This initiative could be an element of a broader CEC strategy to find "flexible loads" that could be shifted to times of solar production.

In the case of building thermal loads, the research need is to determine the most effective strategies for pre-cooling buildings. Strategies may include evaluation of the optimum amount of pre-cooling based on customer comfort considerations; the use of solar and temperature forecasting; algorithms for characterizing building performance through "learning," including non-intrusive data collection through standard available metering; the cost/benefits of added thermal insulation, phase change materials, and improved sealing in retrofit homes; and the cost/benefits of heat pumps (versus A/C units) which would use solar energy for heating needs as well.

In addition, an important goal of this initiative would be to develop control technologies that could support easily-implemented building controls without expensive capital investments. Existing buildings, without modification, could take advantage of pre-cooling methods through the use of existing smart HVAC controller and metering technologies, connected over the Internet to dedicated servers. The initiative could therefore quantify the benefits of this low-cost option relative to the more extensive retrofit approach.

Part 2. Benefits and Impacts

3. If this initiative is successful, either fully or partially, what would be the expected impact? Who are the primary users and/or beneficiaries?

The initiative would primarily address two key issues of renewable integration: the oversupply of solar energy during the day, and the peak loads of the early evening. These are both described by the CAISO "duck curve," and are recognized as critical obstacles in California to higher solar PV penetration levels in the future. Over-generation from PV may force future limits on either the installation and interconnection of PV or the operational curtailment during peak solar hours.

The beneficiaries of this research would be (1) the customers themselves, who would enjoy savings on their electric bills and the effective use of their solar energy; (2) the solar industry, who would benefit from the relaxation of a key market barrier to increased penetration; and (3) all Californians who would benefit from lower carbon emissions.

4. Describe what quantitative or qualitative metrics or indicators would be used to evaluate the impacts of the proposed initiative:

A project to evaluate the benefits of solar pre-cooling would ideally gather data from a wide sample of home types with variations in age, building materials, locations, and occupant preferences. The metrics would be both technical (energy usage, export and import energy, bill impacts) and behavioral (subjective measures of comfort).

The project would therefore require dozens of test homes in order to be statistically significant. Note that CEQA compliance presents a challenge for such a study, especially if physical addresses must be known prior to EPIC proposal submission. The CEC may therefore wish to set up special provisions in the solicitation that would allow a period (e.g., six months to a year) to sign up participating customers and obtain the necessary approvals for the large number of test sites. The CEC could require that proposals include a plan to ensure participation, but not the identification of a large number of sites at the time of the proposal.

5. Please provide a list of peer-reviewed references that support the responses for questions 3 and 4. Proposed initiatives that include peer-reviewed references will be given stronger consideration.

"Residential Mechanical Precooling" (U.S. DOE)
http://www.nrel.gov/docs/fy15osti/63342.pdf

"SMUD Off-Peak Over-cooling Project" (CEC)
http://www.energy.ca.gov/2013publications/CEC-500-2013-066/CEC-500-2013-066.pdf

"Peak load reductions: Electric load shifting with mechanical pre-cooling of residential buildings with low thermal mass"
http://www.sciencedirect.com/science/article/pii/S0360544215001620

6. (For technologies only) What competitive advantages does the proposed technology solution have over current benchmark technologies? If the technology is beyond the prototype stage, what strategies do you suggest to bring to scale?

Part 3. Connection to Energy Commission's EPIC Framework
Energy Commission staff have developed a draft strategic framework to guide the CEC's planning and implementation of EPIC across triennial investment cycles. One of the objectives of the draft strategic framework is to communicate a consistent set of priorities for organizing current and future EPIC investments.

7. Please indicate which of the following strategic framework themes you feel the proposed initiative best fits within:
    - Advance Technology Solutions for Deep Energy Savings in Building and Facilities
    - Accelerate Widespread Customer Adoption of Distributed Energy Resources
    - Increase System Flexibility from Low-Carbon Resources
    - Increase the Cost-Competiveness of Renewable Generation
    - Create a Statewide Ecosystem for Incubating New Energy Innovations
    - Maximize Synergies in the Water-Energy-Food Nexus
    - Develop Tools and Analysis to Inform Energy Policy and Planning Decisions
    - Catalyze Clean Energy Investments in California's Underrepresented and Disadvantaged Communities

If Other, Please Specify